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## MARABOU STORK *LEPTOPTILOS CRUMENIFERUS* BREEDING COLONIES IN UGANDA

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### INTRODUCTION

Marabou Storks *Leptoptilos crumeniferus* breed throughout the non-forested parts of tropical Africa, but are most numerous in the areas of moderate rainfall near the equator. By far the largest recorded breeding populations are in Sudan (Anderson 1949).

Colonies are usually in trees, but occasionally on cliffs. They vary in size from a single nest (which is rare) to several hundred nests. Their sites, as with most colonial nesters, are traditional. One colony was first reported by the Game Department in January 1914 at Agu Swamp, near Lake Kyoga, and Marabous were still breeding there in 1975-6. Judging from what local people say, they had bred in all the intervening years too.

A summary of the breeding population of Marabous in Uganda was published earlier (Pomeroy 1973), and their breeding biology is discussed elsewhere (Pomeroy 1977). This paper aims to provide detailed information about the colonies themselves, the better to enable future observers to make comparisons. The data are derived from many sources. Irregular Reports of the Game Department provide information on a few colonies up to 1947. Several of these are also listed by Pitman (1945). Two colonies were reported by Kahl (1968) and two more by Anderson (1949). Din and Eltringham (1974) give some data on colonies in Rwenzori National Park. Much more information came from enquiry. Letters were sent to Game Wardens and to Wardens of National Parks. Several colonies were located as a result of requests to University students about their home areas. Enquiries from local people, during the course of my travels throughout the country, led to the discoveries of several colonies. All reports were followed up as far as possible, and I visited as many of the colonies as I could myself, to obtain first-hand observations and to follow changes in numbers in successive seasons.

The last new colony to be reported was in March 1972. The fact that none has been found since, despite continued enquiries, leads me to believe that few if any are still unknown.

There is no completely satisfactory way of defining a colony. The dispersion of nests appears to be partly (but not entirely) dependent upon availability of suitable nest-sites. Thus at Kamuli-kwezi in Rwenzori National Park, there were more than 300 nests within a belt of trees about 1 km long. On the other hand there were several 'compound' colonies. For example, at Agu there were three distinct parts, each separated by several kilometres from the next. As a general rule, if the distance between one group of nests and the next exceeded 10 km, I regarded them as separate colonies. Namalu is an exception, because one gap was 14 km, but the information on breeding in that part of Uganda is so scant that I did not feel justified in distinguishing separate colonies.

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TABLE I

Locations and main features (except size, Table 2) of all known Marabou breeding colonies in Uganda. In addition, Kitale is included, although it is in Kenya, 30 km from the Uganda border. The definition of a "colony" is discussed in the Introduction. "Sub-colonies" were recognised mainly for convenience but in each case they were geographically separated from each other, but never by more than 10 km except in the case of Chalanga and Kamulikwezi, which are 14 km apart, but seem to be alternative sites for same colony.

Name of colony	LOCATION			NESTING SITES			NOTES	
	Sub-colonies	UTM Grid Reference (see Note d)	Indication on map (Pomeroy, 1973, Fig. 1)	Area covered by colony (approx. diam., km; s = single tree)	Trees		Associated nesting spp <sup>k</sup>	Probable nearest main food sources <sup>n</sup>
					Ht of cliff (in m)	Ht (in m)		
Larop		UU (69)		?	?	?	?	—
Nyeri		UV (71)		?	?	?	?	s, d
Ajai's Island		UU (21)	a	?	?	?	?	s, d
Aswa		VU 3463	b	<0.5	?	?	—	s, d
Paimol		WU (44)		?			?	s, d
Amiel Rock		WU (52)	c	<0.5	300		—	s, d
Chobe	{ "Marabou tree" Karuma G. R.	VT 0548 VT 04e	d	s 8	25-30 20-30		—	W, s W, s
Kabalega Falls	{ "Marabou tree" Main colony	UT 4743 UT 44f	e	s 8	25 20-30		—	W W
Hoima		US 1559	f	0.2 <sup>p</sup>	20-25		—	r, s
Kikube		US 0248	g	0.4	15-30		Bhbm	s
Ruimu River		TR (24)		?	?		Pbp	s, d
Rwenzori N. P.	{ Kamulikwezi Chalanga	SR 1716 SR 8917	h	1.0 0.8	8-15 20-30		Pbp Pbp	W, r, s W
Rwenshama		RK 1255	i	2.0	8-15		Pbp	F, W, r
Kiti		UQ 7392	j	0.8	15-20		Bhw	s
Natete		VR 4834	k	0.5	15-25		Bhw	R
Kololo	{ Lugogo Abattoir	VR 5737 VR 5636	l l	s s	12-15 15		—	R R

a: referred to as Kasese in Din & Eltringham (1974)  
b: referred to as Kasazu in Din & Eltringham (1974)  
c: Kitale is in Kenya  
d: small colonies whose exact position is known are located to the nearest km, e.g. VU 3463. Larger colonies (see notes e to h) are given as 10 km references, e.g. VT 04. Brackets, e.g. UU (69) indicate that the exact site is not known.  
e: see Appendix, (i)  
f: see Appendix, (ii)  
g: see Appendix, (iii)  
h: see Appendix, (iv)  
i: Ab *Albizia coriaria*, Oliv.  
Ac *Acacia* sp.  
Al *A. lahai*, Benth.  
At *Antiaris toxicaria* (Pers.) Lesch.  
Ce *Chlorophora excelsa*  
Cm *Croton macrostachyus*, Del. forest  
Cp *Cupressus* sp. (exotic)  
Ed *Euphorbia dawsoni*  
j: Various *Acacias* etc, including *A. sieberiana*, *Albizia zygia* and *Entandrophragma* spp.  
k: Bhb Black-headed Heron  
Ardea *melanocephala*  
Bhw Black-headed Weaver  
Ploc *Plocus cucullatus*  
Pbp Pink-backed Pelican  
Pelecanus *rufescens*  
Vw Vieillot's Black Weaver  
Ploc *Plocus nigerrimus*



## THE BREEDING COLONIES

Table 1 lists all of the colonies known in Uganda. Four of these are on cliffs, a situation which is common in southern Sudan (Anderson 1949) but recorded rarely elsewhere (e.g. Kalambo Falls, Tanzania (Moreau 1943)). Mvule trees *Chlorophora excelsa* (Welw.) Benth. & Hook.f. are widespread in southern and central Uganda (Eggeling and Dale 1951) and nests in other species were rare within these areas. In many places mvule trees are bare during part, at least, of the time when Marabous are nesting in them, but this correlation is probably coincidental. Elsewhere in Uganda *Acacia* spp. were chosen in two colonies although in other parts of eastern Africa they predominate (Kahl 1968, North 1943), whilst even baobabs *Adansonia digitata* L. (North 1943), *Balanites* sp. and figs *Ficus* sp. (Anderson 1949) have been recorded.

Of the 26 colonies listed in Table 1, six were known to be in use in 1975/6, a further 12 were probably still used and six more possibly so (Table 2). Most colonies had less than 50 nests, although the range in size is considerable. Several small colonies seem to have been short-lived, but a number of the larger colonies have been used for decades.

Marabou colonies are less compact than those of many colonial species. Some spread over a considerable distance, whilst still appearing to be all parts of the same colony. However, in some of these cases (e.g. Chobe, and Kabalega Falls main colony) each individual tree is in sight of the next. In other instances there are several sub-colonies: two at Kakoge and three at Agu and Namalu. The individual sub-colonies usually involved more than one tree but were each less than a kilometre across. Further, each 'compound' colony was separated by at least 50 km from the next colony.

Associations between Marabous and one or more other species of bird occurred at a majority of colonies (Table 1). In the years from 1967 to 1970, Kamulikwezi was the largest known colony in Uganda of both Marabou Storks and Pink-backed Pelicans *Pelecanus rufescens* (Din and Eltringham 1974). Four or five other colonies were also shared by both species. In most cases at least the association probably arose simply from both species requiring a similar resource which was in short supply (Pomeroy 1976).

Two colonies were shared with Black-headed Herons *Ardea melanocephala* but this again had the appearance of a chance association. The Game Department Report for 1947 stated that both species nested together at Kikube, but Kahl (1968), reporting his visits in 1963 and 1966 did not mention herons, nor were they there in 1971/2. At Luwero, so far as is known, Marabous have only nested once at site (b), which is a single mvule tree that has been used for many years by herons. This tree was interesting in that it also contained nests of Vieillots' Black Weaver *Ploceus nigerrimus*. The association with weavers was, in fact, widespread although elsewhere the species involved was the Black-headed or Village Weaver *Ploceus cucullatus*. At Kiti, Marabous were nesting in two mvule trees, one of which contained many weavers' nests, but the other had none. At Namukanga, three Marabou trees out of seven had weavers' nests and at Kyanaka one out of four. At Kitale, Kenya one tree out of four was shared, and it was the one with most Marabous. In all cases the Marabous' nests were at the tops of the trees, and the weavers' some 2-5 m below.

Marabous usually lay 3 eggs, less often 2, the average being 2.7 (Pomeroy 1977). Of the young which hatch, less than half survive to fledge. At several colonies it was reported that the branches supporting nests sometimes broke in high winds, especially during thunderstorms. A surprising number of young — possibly as many as 10% — were lost by simply falling from the nest. They usually reached the ground safely but were ignored by the parents and soon perished. Kahl (1966) observed that 18 nesting attempts at Kitale involved three instances of nests being used again after loss of young or eggs, although the second user was not necessarily the same as the first. At Natete, where detailed studies were also made, the re-use of nests by different birds was not recorded, although it may have occurred. The apparent incubation periods in some nests were very long indeed implying that the first clutch failed to hatch and that this was followed by re-laying, but that could well have been by the same pair.

Regular observations of individual nests at Natete provided a comprehensive picture of breeding activity over four seasons. A representative example is shown in Figure 1. Few nests were abandoned before the colony had reached full size. In the 1971-2 breeding season, three trees were used at Natete, one (H) containing most of the nests. This was the first tree to be colonised and it produced most young per nest. The Kololo colony (with one tree) was about





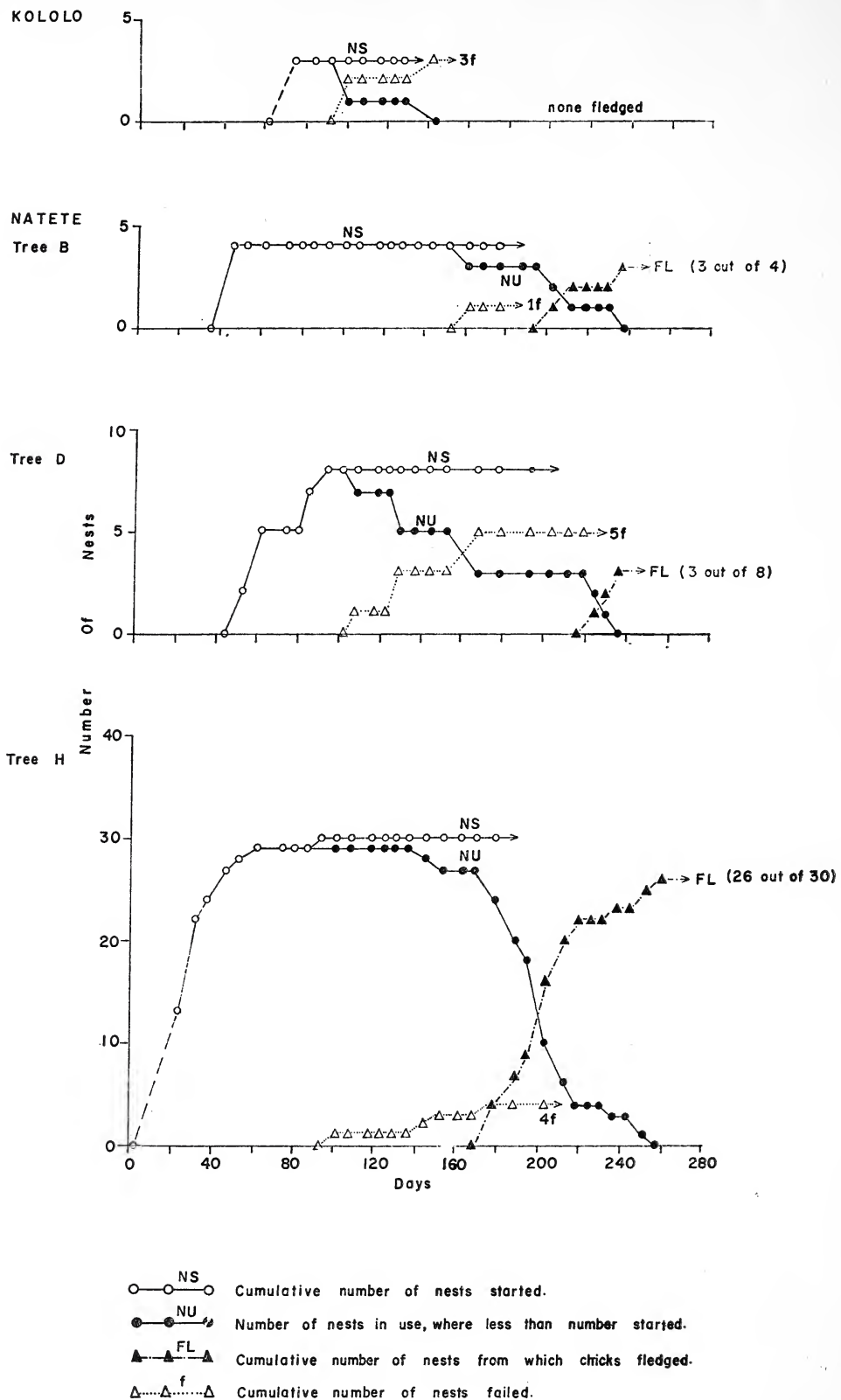


Figure 1. Records of the two Marabou breeding colonies in Kampala during the 1971/2 breeding season. The mean egg-laying date at Natete was estimated as day 48; day 0 was 19 October 1971.

11 km away and was also observed throughout the season. It contained only three nests, all of which failed.

Undefined Marabou nests are promptly raided by other Marabous as convenient sources of nesting material. Thus abandoned nests disappear rapidly and the number of nests present in a colony, at any given time, indicates quite accurately the number in use, even towards the end of the season. A consequence of this behaviour is that although the nests are quite well constructed, completely new ones have to be built each year.

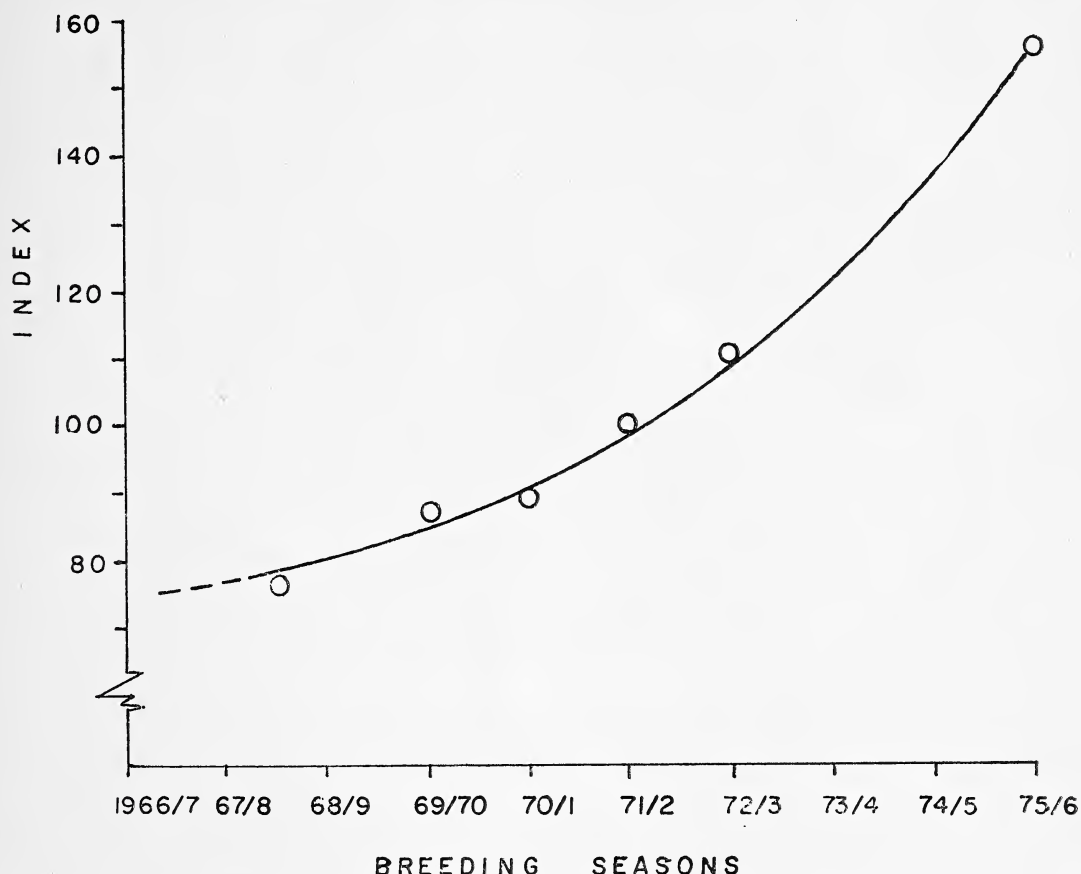


Figure 2. Index of estimated Marabou breeding populations in Uganda (1971/2 was taken as 100).

The number of nests in use within a colony increases to a peak shortly after the average date of egg-laying and then declines, slowly at first but rapidly after about four months as the young begin to fledge. The "age" of a colony, measured in days from the mean date of egg-laying, can be estimated in two ways. The most accurate is by observing individual birds at their nests, since incubation starts with the laying of the first egg (Kahl 1966). But the young can also be aged quite accurately from their appearance (Kahl 1966, Pomeroy 1977) and once they are six weeks or older they are large enough to be observed from the ground with binoculars. Observations at Natete over four seasons, supplemented by data from a few other colonies visited several times in one season, showed that the maximum size of a colony could be predicted fairly accurately from its "age". Thus at the mean date of egg-laying, the colony was only about four-fifths of its maximum size, which was reached about 30 days later. After that there was a progressive decline in the number of nests in use, to about 80% again some 130 days after the mean date of

egg-laying. Hence one could assume that a colony whose young were, on average, 100 days old, had declined to about 80% of its maximum size (the incubation period being 30 days). Conversely, if visited at this time, the maximum number of nests could be predicted as having been 125% of the number still in use. The maximum size was equal (as in Figure 1, day 95) or only slightly less than the number of nests started.

TABLE 3

*Estimated maximum sizes of Marabou colonies. In a few cases a colony was only visited once, but at or near to the time when it was likely to be of maximum size. In all other cases the method of estimation is indicated by superscripts referring to notes below.*

Name of colony <sup>a</sup>	BREEDING SEASONS					
	1966-9 <sup>c</sup>	1969-70	1970-1	1971-2	1972-3	1975-6
Chobe	{ "Marabou tree" Karuma G. R.	8	12	12 <sup>e</sup> (127) <sup>i</sup>	3 127 <sup>d</sup>	0 100
Kabalega Falls		15	3	0 70 <sup>e</sup> 15 <sup>d</sup>	0 115 <sup>d</sup> 42 <sup>d</sup>	0
Hoima	{ "Marabou tree" Main colony			151 <sup>d</sup>	125 <sup>d</sup>	
Kikube		85 <sup>d</sup>				
Rwenzori N.P. <sup>b</sup>		350 <sup>h</sup>	400 <sup>h</sup>	350 <sup>f</sup>	300 <sup>d</sup>	
Rwenshama		0 <sup>f</sup>	0 <sup>f</sup>	35 <sup>e</sup>	140 <sup>e</sup>	
Kiti				7 <sup>d</sup>		0
Natete		0	10 <sup>g</sup>	42 <sup>g</sup>	60 <sup>g</sup>	45 <sup>d</sup>
Kololo				4 <sup>g</sup>	0	0
Luwero		10	1	2	0	0
Kakoge	{ Namukanga Kyanaka		0	42 <sup>d</sup>	50 <sup>d</sup>	42 <sup>d</sup>
				71 <sup>d</sup>	55 <sup>d</sup>	124 <sup>d</sup>
Nakitoma				80 <sup>d</sup>	102 <sup>d</sup>	
Pallisa			40	20	19 <sup>d</sup>	
Agu				105	140 <sup>d</sup>	370 <sup>d</sup>
Aduku				45	45 <sup>d</sup>	55 <sup>d</sup>
Kitale		18		(65) <sup>i</sup>	65 <sup>d</sup>	74 <sup>d</sup>

## NOTES:

a: Details are in Tables 1 and 2.

b: Kamulikwezi and Chalanga combined.

c: Combined.

d: Calculated from estimated mean date of egg-laying—see text and Fig. 1.

e: As d, but no young present, therefore based on assumed date of egg-laying (see Pomeroy 1977).

f: Assumed.

g: Individual nests observed through season, hence this figure is exact.

h: From Pomeroy, 1977.

i: Figures in brackets are for 1972-3, used here to complete the estimates for 1971-2.

It was rarely possible to time all visits to colonies to coincide with their likely maxima but for the purposes of comparing one year with another the estimated maxima provide a logical basis. This has been done for a number of colonies in Table 3, using where necessary the criteria outlined above.

Local informants can often say what the nestlings are fed upon, because some food drops to the ground. At six colonies, fish was stated to be their only food, but fish, snakes and frogs were reported at a seventh. At Luwero, it was said that Marabous had eaten some young from herons' nests in the same tree, and Din and Eltringham (1974) mention Marabous as occasional predators of nestling pelicans in the shared colony at Kamulikwezi. However, most nestlings at that colony were fed on fish: *Protopterus*, *Tilapia* and *Haplochromis* spp., all of which are common in the nearby Lake George. Some of these may have been caught by the parents, but many came from the local fishing villages where some were rejected by the fisherman although others were just pirated. Other food regurgitated by young at Kamulikwezi included a 40 cm water snake, *Natriciteres olivacea* (Peters) and a freshwater gastropod about 6 cm across. Kahl (1966) found that Marabous at Kitale brought some food to the nest from the adjacent rubbish dump and abattoir, and the same occurred at the Kampala colonies, although fish was still the major item in Kampala.



There are several records of colonies having been abandoned. In Rwenzori National Park, most of the Marabous moved to Chalanga in the 1970-1 breeding season, only 40 nests remaining at Kamulikwezi. Most of the latter were abandoned before the young fledged. In two other cases, Kiti and Luwero (a), the birds had to leave traditional sites when the trees they used for nesting were felled.

## DISCUSSION

The choice of sites for breeding colonies seems to be determined primarily by availability of food. It is obviously advantageous to breed as close as possible to the food source. But Marabous, like vultures, are very efficient soarers and indeed they compare closely in their soaring ability (Pennycuik 1972). Houston (1976) found that White-backed Vultures *Gyps africanus* may travel up to 80 km from the nest to obtain food. Fish predominates in the food of nestling Marabous and it is noticeable from Table 1 that all but 7 of the 27 colonies were within 5 km of a swamp whilst all were within 50 km. It seems probable that these swamps were the major source of food. I was able to make few direct observations of Marabous feeding in swamps, many of which are difficult of access, but local fishermen almost invariably mentioned swamps on being asked where nesting Marabous fed. This is in marked contrast to their food at other times, when scavenging predominates (Kahl 1966, Pomeroy 1973, 1975).

Mvule trees are excellent for nesting because of their strong branches. An average pair of adult Marabous weighs about 12.7 kg (Pomeroy 1977) and presumably two young weigh as much by the time they fledge. The nest itself is a bulky structure of sticks so the total weight which has to be supported could easily amount to 30 kg. A few other trees are also used (Table 1) but cliff-nesting is unusual in Uganda and in most other places. However this may simply be because suitable cliffs are rarer than suitable trees.

Nesting-trees may be damaged by the combined effects of the birds' droppings and their weighty nests but there is no evidence that this is significant except in the case of *Euphorbia dawsei*, N.E.Br. (Din and Eltringham 1974). The Marabous breeding in the north of Rwenzori National Park moved from one site to another in 1970 (Table 2), possibly because too many of the *E. dawsei* trees at the original site had been damaged to the point where they could no longer support a nest.

Whilst the distribution of recorded colonies is quite readily explained in relation to feeding areas, the apparent absence of colonies in the south-east and south-west of the country is puzzling. Both areas have quite high human populations, reducing the chances of colonies going unrecorded. (Predation by man is uncommon, so that was probably not the cause). There are extensive swamps in these areas, especially near Lake Victoria, and birds occur regularly at several places, particularly Mbarara.

The compactness of some colonies contrasts with the dispersion of others. Compactness is correlated with breeding success and the nests at the centre of a colony are the most successful (Pomeroy 1977). But compactness is possible only where sufficient suitable trees are close together, which is not often the case. Mvule trees for example tend to be scattered and are commonly 100 to 1000 m apart, even in areas suitable for them.

I estimated the total Marabou breeding population for the whole of Uganda as between 2316 and 2862 birds in the 1971/2 breeding season (Pomeroy 1973), assuming that all major colonies were known. (These figures were not corrected in the way described above and are probably an under-estimate). The comparative ease with which at least a reasonable sample of the colonies can be visited makes it practicable to monitor population trends for the whole country. The data in Table 3 can be used to produce an index of Marabou breeding populations from 1966-9 to 1975-6. When each column is compared separately with 1971/2, the season for which the coverage was most complete, the relative abundance for other seasons can be estimated by totalling the populations in each of those seasons and comparing with the corresponding totals for 1971/2. Taking 1971/2 as an arbitrary 100 yields the results shown in Figure 2; there seems to have been a fairly regular rate of increase over a 10-year period, during which time the breeding population has approximately doubled.

There are indications that Marabous were comparatively rare in the early years of the present century. For instance Jackson (1938, p. 79) who travelled extensively before the First World War stated that "In Uganda (the Marabou) was only met in Ankole and Toro". The increase

must have begun after that but by 1966-9 the breeding population was well over 1000 pairs. By 1975/6 it probably exceeded 2200 pairs.

About half of the Marabou colonies in Uganda were shared with other species. Associations with pelicans were probably fortuitous, each species requiring strong, tall trees, a comparatively rare resource. Mixed colonies of Marabous and pelicans have also been recorded in West Africa (Bannerman 1953, Mackworth-Praed and Grant 1957, Serle 1943) and Somalia (North 1943). The last also contained Yellow-billed Storks *Ibis ibis*, as did two colonies in Sudan (Anderson 1949). In the Okavango delta in Botswana, Child (1972) reported two mixed "heronries" in which the Marabou was one of several species breeding together.

A more remarkable association is that with weavers. There are several reports of weavers nesting in the same tree as a raptor (e.g. Moreau 1942, Brown and Amadon 1968). In Nigeria, Walsh and Walsh (1976) found that 8 colonies out of 12 of the Red-headed Weaver *Malimbus rubriceps* were in trees with raptors' nests. In Uganda weavers were found nesting with Marabous in about a third of the colonies. However, both species of weavers concerned are relatively common in Uganda and the proportion of their colonies which were in Marabou trees must have been very small. Weavers' nests sometimes numbered 50 in a tree but in most colonies only one or two of the trees used by Marabous were shared with weavers. One can readily imagine, as most authors have, that the presence of nesting raptors confers some protection on the weavers below, especially from snakes and the smaller mammalian predators. This benefit could hardly apply to weavers nesting below Marabous however, and one can only suppose that the primary stimulus to the weavers' behaviour is the sight of a large nest. Nevertheless, the fact that most Marabou colonies do not have weavers, despite the latter's relative abundance, argues that the weavers are usually successful in distinguishing between Marabous and raptors.

In general, birds breed at the time of year when the food supply for their nestlings is likely to be greatest. Marabous find food most readily during the dry season, especially towards its end (Kahl 1966, Pomeroy 1973) and consequently start breeding at the end of the wet season (Pomeroy 1977). Thus the young are in the nest during the dry season but in Uganda the rains have often begun before they fledge. In most colonies Marabous leave the area as soon as the young have fledged and are rarely seen until the next breeding season.

### SUMMARY

Extensive enquiries were made in an attempt to locate all Marabou breeding colonies in Uganda. Twenty six were found of which about 18 were thought still to be in use in the 1975/6 breeding season. The population then was estimated at more than 2000 pairs. There is evidence that numbers have been increasing during most of this century and that they have doubled in the past 10 years.

Marabous sometimes have weavers nesting below them, reminiscent of weavers' colonies below a raptor's nest. The Marabous could not, however, confer the advantages that a raptor might. In other colonies Marabous breed with Pink-backed Pelicans or more rarely with Black-headed Herons.

Colonies are occasionally on cliffs but usually in trees, especially mvule *Chlorophora excelsa*. The distribution of trees means that few colonies are compact, some extending over several kilometres. Most colonies are within 5 km of a swamp, which is probably where the adults obtain the fish that forms the major part of the nestlings' diet.

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## APPENDIX

Additional information on four of the compound colonies (see Table 1).

- (i) *Karuma Game Reserve*. In 1975-6 the colony was scattered between ten mvule trees. All were on the south side of the River Nile, within 2 km of its bank, and extended from about 3 km to the west of Chobe to about 5 km to the east. The "Marabou tree", the only large mvule on the north bank, was last used in 1972/3.
- (ii) *Kabalega Falls main colony*. This colony was similar to Karuma. In the 1972/3 season, seven trees were in use, spread through an area some 6 km from east to west and 8 km from north to south.
- (iii) *Agu Swamp*. There were three sub-colonies. In 1975/6, one at Opelu (Grid Ref WS 8258) involved nine trees; at Atuta dam (Odwarat, G. R. WS 8367) six trees were used; and at Kumel (G. R. WS 8867) there was one (C.P.A. Aseun, pers com).
- (iv) *Namalu and Debasian*. In the 1972/3 season, the local Forestry Officer told me of two sub-colonies about 5 km apart: one in low *Acacia sieberiana*, DC. trees at approximately XS 8494, and a second in *Albizia* spp. (including *A. zygia* (DC.) Macbr.) at XS 8198. Nests were also reported from a group of trees including *A. sieberiana*, *Entandrophragma angolense* (Welw.) C.DC. and *E. utile* (Dawe & Sprague) Sprague at XT 9506. This is some 14 km from the other two sites and probably should be considered as a separate colony.

The 1929 Report of the Uganda Game Department speaks of Marabous breeding "in thousands" on the west side of the Debasian Mountains. The site is exceedingly inaccessible but is known to J. Weatherby. He says (*in litt.*) that the nests are at a place called Irrion ("house of the big birds" in Tepes), near the source of the Loghoma River at about XS 9389, i.e. some 12 km east of the *A. sieberiana* site. The number of nests was not counted, but was of the order of a hundred in about 1969.

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